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ABSTRACT

The 20th Century has witnessed tremendous changes in the American workforce, communications and information technology, and the nation's economy. Changes in the next 20 years are projected to surpass those of the past 80 years. Historically, the focal point for reacting to changes in skills needed in the workplace has been the educational system, which provided each new generation with the skills that would serve throughout a lifetime of employment. Now the skills required for continued employment are changing so rapidly that as many as 20 million Americans will need to be retrained in the next 10 years as their current skills become almost obsolete. Community colleges will be a necessary force for the retraining of individuals whose livelihood has become displaced by, for example, robotics; whose jobs have not been replaced after layoff; whose skills must be upgraded due to technological changes; and who for their own professional advancement must become more knowledgeable. Community colleges must be prepared to take advantage of educational changes expected over the next 20 years, including: (1) the concept of lifelong learning will be merged and incorporated into the realms of both work and leisure; (2) education, via computer electronics, will become an integral part of everyone's daily life; (3) portable delivery systems will be ubiquitous; (4) market disaggregation will increasingly occur in education; and (5) teachers will become partners with their students in the discovery process. (LAL)

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"A New Relationship: The Teacher And The Learner
In An Age Of Telecommunication"

by

Norman Watson

Presented to the League for Innovation
Newport Beach, California

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When the 20th Century began, the American work force was very different from today. Nearly half of America's workers earned their living on farms; today only four percent do. Three million U.S. farmers today grow almost twice as much food as twelve million did in 1910. The steel industry was in its infancy; the automobile industry did not exist. Four hundred thirty-six thousand railroad workers hauled more freight today than 1.4 million workers did at the end of World War II. Computer Technology lay two generations away, in the minds of scientists yet to be born. In the 1920's Lee De Forest, inventor of the vacuum tube, went into the laboratories to see a demonstration of the first black and white television. After seeing it, he wrote, "While theoretically and technically television may be feasible, commercially and financially, I consider it an impossibility, a development of which we need to waste little time dreaming." This was from the man who developed the vacuum tube.

When the first IBM computer, called the Mark I, was delivered to Harvard, the head of the computer lab, in his introductory remarks in 1944, said that six machines would satisfy the total demands of the U.S. forever. The transformation of our jobs, the movement of our people, the improvements in our skills over the first 80 years of this century have been stunning. But it is entirely likely that the changes recorded in this time span will be matched and surpassed by the changes of the final 20 years of this century.

In 1910, A.T. & T. handled six million telephone calls with a staff of 120,000. That is almost fifty calls a year for each employee. In 1979 the system handled 185 billion calls with less than a million employees, or 185,000 calls per employee. Handling current telephone traffic at the 1910 level of technology and company staff would require forty times the present U.S. labor force.

In the 1890's, a British publication, the Electrician, saw the telephone as a positive menace. "It seems to us that we are getting perilously close to the ideal of the modern utopian whose life is to consist of sitting in armchairs and pressing a button. It is not a desirable prospect: We shall have no wants, no money, no ambitions, no youth, no desires, no individuality, no names and nothing wise about us."

The pace will accelerate rapidly in the coming two decades with a wide array of new innovations. Among them are:

1. Josephson Junctions, computer circuits that are superconducting metals, which lose all resistance at very low temperatures. This enables them to handle computations in trillionths of a second, a hundred times faster than existing computer circuits.
2. Wave-guide communication channels, carrying the equivalent of a quarter-million telephone circuits on a light beam shot down a hollow tube the width of a car exhaust pipe.
3. Computerized storage systems, now under development, that will allow as much information as is in the entire book collection of the Library of Congress in a tabletop container.
4. Massive space platforms, structures assembled thousands of miles above the equator, from which will be hung communication satellites capable of beaming signals into pocket-sized portable receivers.

The significance of the projection that the changes in the next 20 years will surpass those of the last 80 years is overwhelming. It means that all this displacement, all the adjustments, all the technological advances of 80 years will be collapsed into 20 years. While it may be hard to believe that our economic society will change that quickly in two decades,

consider what has happened already--during just the first two years of that period.

There are one-third fewer auto workers today than when this decade first began. For the first time in our history, more than half the work force is female. The last black-and-white television set was produced in America--probably ever--while computers passed \$1 billion in sales. The Washington Star died, in part because it could not move papers efficiently from Capitol Hill to Silver Springs, Maryland, at 4 p.m. Yet Gannett begins a newspaper that is designed for national simultaneous distribution. With these examples, just reflective of all the changes in the past two years, the next 18 are likely to be exciting, challenging, but also tough on all of us.

Everywhere we look there is change, but nowhere is it greater than in the technological progress reshaping the very fundamentals of the American economy. The national issue of 1983 is whether we are ready to deal with that change. Will we despair in the face of it? Will we resist and deny it or will we use that change to better the employment opportunities for the people of our nation? The answer may lie in the way we define the problem.

Historically, the focal point for reacting to changes in skill needs in the workplace has been our education system. Each new generation was sent into the marketplace with a set of skills that would serve it usefully for a lifetime of productive employment. But now the skills required for continued employment are changing so rapidly that "one skill per generation" is no longer sufficient.

Some estimates indicate that as many as 20 million Americans will need to be entirely retrained in the next ten years as their current skills become

almost obsolete. The American Society of Engineers estimates that, by 1990, more than half the work force on the industrial plant floor will be white-collar technicians who are there to maintain the computer and robot systems that are manufacturing our durable products.

Today we are living in the postindustrial/postelectronic and postatomic eras. We are residing in the information age. All of us are so bombarded with information that assimilation of what we read and hear is for most of us a mental task of Herculean proportions, whether we know it or not. Each of our brains reaches a point of data saturation (at different rates, of course) resulting in a flashflood of ignored messages. We must become more selective in what we wish to retain; we must discover the best means of data transmission and we must choose our favorite method of receiving those blasts of messages.

Think for a moment how we receive messages during the course of the day: Your senses of smell, taste, hearing and feeling; conversation one on one or speeches, newspapers, magazines, telephones, radios, televisions, phonographs, tape recorders, computers. These messages range in importance-- from sensing the weather to hearing a child's complaint, to filtering out the thousands of advertising announcements foisted upon us 24 hours a day.

Having been a professional educator for the past three decades, I can tell you that there really have been very few advances in instructional techniques over the past several thousand years. Three critical stages in evolution of information: Original printed alphabet. Then nothing happened for more than 5,000 years until Gutenberg in 1452, invented moveable type,

thereby allowing for the "rapid" reproduction of books. By the way, printed books really did not emerge en masse for another 300 years. But when it did occur with regularity, the power of the educated clergy waned as the ability to print books (rather than scribe them) expanded, allowing for increased literacy of the masses, free and disparate thinking and intellectual enlightenment.

There is a fable about some 15th century citizens faced with evaluating a new technology. In the city of Mainz, Germany, Meister Johann Gutenberg has just developed a machine that can reproduce manuscript-like pages in many copies. News of his work has reached the local rulers, the Electors of the Rheinland Palatinate. In the spirit of renaissance inquiry, the Electors ask a group of scholars and businessmen to assess the new machine's impact on the local economy and culture. Since bureaucracy is just beginning to assert itself, the group is designated the Select Committee to Evaluate Multiple Transcript Productions.

The committee visits Gutenberg's workshop, where the proud inventor demonstrates his machine. The committee is impressed, but skeptical. After considerable debate, the group submits the report to the Electorate. The machine is undoubtedly a technological advance, the report continued, but it has only limited application to the Palatinate's need. The committee recommends that the government not invest research and development funds in the project. Its reasons are direct and cogent: 1) A large work force of monks copying manuscripts would lose their jobs if the Gutenberg machine were encouraged; 2) there is no heavy demand for multiple copies of manuscripts; and 3) the long-term market for printed books is doubtful due to the low literacy rate.

Let's advance 550 years to the electronic era, where computers have allowed the common man to enjoy accessibility to all the knowledge that ever was, on one chip or disc. A far cry from 12 angels on the head of a pin as professed by Thomas Aquinas in his Summa Theologica written in the year 1258.

What else do we have coming down the educational/technological pike? Direct satellite broadcasts into your home. A simple dish antenna will allow you to select hundreds of viewing opportunities without commercials--if we're lucky.

--Two way cable communication, where you can talk directly to the television and get a response from the person on the other side of the camera. Also, computer to television interchange.

--Laser and Glassfiber transmission, channeling thousands of bits of information or conversations simultaneously along a conduit no larger in diameter than common coaxial cable.

How about telepathy? Scientists are doggedly pursuing brain wave to brain wave communication. Who knows where the limits of technology and learning will take us. I for one wish to employ every means possible, without dispensing with the tried and true classroom instructor. But the traditional instructor must be tuned in to new developments, and employ them in his teaching. Where would we be today if the learned few had tarred and feathered Gutenberg? Probably some folks had suggested it.

Community colleges are one of the great educational developments of this century, for before community colleges there never had been a system of higher education which offered advanced learning to everyone, no matter his or her station in life.

Our country industrially is in a period of flux. The blue collars are fading. We are becoming a service-oriented nation; an information nation. Community colleges are a necessary force for the retraining of individuals whose livelihood has become displaced by, for example, robotics; whose jobs have not been replaced after layoff; whose skills must be upgraded due to technology; who for their own occupational/professional advancement must become more knowledgeable.

The changes that will take place in education during the next 20 years will not be merely dramatic, they will be spectacular. Those of you in this room have the exciting prospect of riding these waves of change into the future.

1. The concept of lifelong learning will of necessity be merged and incorporated into the realms of both work and leisure. With the rapid changes that technology is bringing about in the world of work, individuals will be living in a constant learning mode.

An illustration of this process is taking place at Holmes and Narver a nearby architectural firm in Orange. The firm is currently cooperating with the community colleges in Orange County through our Technology Exchange Center to provide instruction to all of their employees in utilizing computer graphics in the design process. At the present time they have trained 35% of their work force in computer graphics and it is their objective to train the remaining 65% during the next year.

2. Education, via computer electronics, will become an integral part of everyone's daily life, becoming realtime and lifelong and implemented at all educational levels and at all age levels.

3. Portable educational delivery systems, on-the-job, full-time, 24 hours per day and lifelong, will be ubiquitous.
4. Market disaggregation will increasingly occur in education. Business, government, unions, civic groups, and the military will all accelerate their educational activities. Literacy training, skills development and continuing education will be provided by military force and unions. Industry will respond on a large scale. A.T.&T spent 1.7 billion last year on education and training, more than the State of California provides for community colleges. Statistics show that of 60 million adult Americans taking post-baccalaureate and non-degree classes, only about 13 million are involved in a formal college or university program.
5. Teachers will become partners with students in the search and discovery process. Beginning early in elementary school, instructors will serve as guides to students assisting them in the acquisition and processing of data from a wide variety of sources. Immediate feedback for the learner will increase satisfaction and accelerate learning curves. Students will proceed with greater sophistication in secondary schools. Computer literacy will be commonplace and personal computers will be tools used by all students. By the time students progress to post-secondary levels, networking will be increasingly complex and students' access to data will be limitless. The possibilities for individualized learning approaches and for research will be manifold.

The potential of education is only limited by our imagination.

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